

2002 National Mu Alpha Theta Convention
Ratio, Proportion, and Variation Topic Test
Theta Division

1. What fractional part of the graph of $-29 \leq x \leq 5$ is the segment represented by $-27 \leq x \leq -10$?
- a. $17/24$ b. $37/34$ c. $1/2$ d. 2 e. NOTA

2. $\frac{x^2 - 2x - 3}{2x^2 - 5x - 3} > \frac{2}{3}$, find x.
- a. $x > 1$ b. $x < 1$ c. $x > -1$ d. $x < -1$ e. NOTA

3. Given: x and y have a linear relationship. Find the change in y per change in x in the following table.

X	1	2	3	4	5
Y	6	10	14	18	22

- a. 6 b. 5 c. $1/4$ d. 4 e. NOTA
4. If a car travels 400 miles on 16 gallons of gas, how many miles could it travel, under the same conditions, on 4.5 gallons of gas?
- a. 112.5 miles b. 1422 miles c. 72 miles d. 25 miles e. NOTA
5. Find the ratio of the smaller volume to the larger volume of the following rectangular prisms:
Prism M has length, width, height of 16, 3, and 4 inches respectively
Prism N has length, width, height of 8, 6, and 6 inches respectively
- a. $1/2$ b. $5/8$ c. $2/3$ d. $3/4$ e. NOTA
6. Find a value for n if the slope of a line through these two points, $(-3n, 3)$ and

$(5n, 5n+4)$, is $2/3$.

- a. 3 b. 2 c. $-3/11$ d. $1/7$ e. NOTA

7. The lengths of the two legs of a right triangle are in the ratio 2:4. If the length of the hypotenuse is 16 feet, find the length of the shorter leg.

- a. $\frac{4\sqrt{5}}{5}$ b. $\frac{16\sqrt{5}}{5}$ c. $\frac{8\sqrt{5}}{5}$ d. $\frac{16}{3}$ e. NOTA

8. Given: X is directly proportional to Y in the following table. What is the value of b?

X	6	14	<i>b</i>
Y	15	35	50

- a. 22 b. 34 c. 49 d. 30 e. NOTA

9. Given: X and Y have a linear relationship in the following table. Find b.

X	5	9	<i>b</i>
Y	14	22	44

- a. 18 b. 20 c. 22 d. 24 e. NOTA

10. x and f(x) are directly related. If $f(-4) = 20$ and $f(5) = b$, find b.

- a. 20 b. 20 c. -25 d. -20 e. NOTA

11. Solve for a: $\frac{6}{3a+6} = \frac{2}{a+2}$

- a. -2 b. -6 c. all real numbers d. all real numbers, except -2
e. NOTA

12. Which of the following could be the relationship between X and Y in the table below?

X	2	5	9	16
Y	-1	5	13	27

- a. Directly related b. linearly related c. inversely related
d. quadratically related e. NOTA

13. A cube has a side of x. Each side is quadrupled. The ratio of the surface area of the original cube to the surface area of the new cube is:

- a. 16 b. 64 c. 1/16 d. 1/64 e. NOTA

14. Solve for all values of x: $\frac{x-2}{4} = \frac{16}{x-2}$

- a. 2 b. {} c. -6 d. 10 e. NOTA

15. During the first 8 games of the soccer season, Jan got 57 shots on goal. How many shots must she have in the next 6 games to increase her average to 8 shots on goal per game?

- a. 55 b. 43 c. 40 d. 30 e. NOTA

16. Given that y varies directly with x and when x = 3, y = 12, what is the value of y if the sum of y and twice x is 24?

- a. 12 b. 16 c. 20 d. 24 e. NOTA

17. A 150 liter batch of a mixture contains 12 liters of a chemical. Find the least number of liters of the chemical which must be added to create a mixture that is at least 20% chemical?

- a. 20 b. 22.5 c. 25 d. 30
e. NOTA

18. Complete the table so that it represents an inverse variation between X and Y.

X	2	4	-1	-8
Y	8	?	?	?

- a. 16, -4, -1/2 b. 4, -16, 2 c. 4, -16, -2 d. -16, 4, 1/2
e. NOTA

19. Given that x and y vary inversely, and x = 2.5 when y = 14. What is the value of x when y = -8?

- a. 5.6 b. -5.6 c. 4.375 d. -4.375 e. NOTA

20. It takes Dan 20 minutes to mow the lawn; it takes his sister, Sue, 15 minutes to mow the same lawn. If they work together, how long will it take to mow the lawn?

- a. 8 4/7 minutes b. 10 minutes c. 17.5 minutes d. 45 minutes
e. NOTA

21. 450 milliliters of a 5% salt solution is heated until all but 200 ml has evaporated. What percent of the remaining mixture is salt?

- a. 15% b. 20% c. 22.5% d. 11.25% e. NOTA

22. A soccer team has 16 wins and 13 losses. What is the least number of games which the team must win in a row in order for its winning percentage to be above 60%?

- a. 3.5 b. 4 c. 5 d. 6 e. NOTA

23. Find A and B:
$$\frac{A}{x+2} + \frac{B}{x-1} = \frac{7x+2}{x^2+x-2}$$

- a. A=7, B=2 b. A=-4, B=3 c. A = -7, B = -2 d. A = 4, B = 3
e. NOTA

24. Presently, Bill is 13 and his dad is 35. What will their ages be when the ratio of their ages is 2/3?

- a. 22 & 33 b. 24 & 36 c. 31 years d. 44 & 66 e. NOTA

25. So far, Salima has answered 50 questions correctly out of the 58 questions she has completed

on her test. If she can answer 13 more questions correctly, she will score more than 90% on the test. How many questions are on the test?

- a. less than 70
- b. 70
- c. more than 70
- d. it is not possible to score more than 90%
- e. NOTA

26. Tim takes 3 hours longer to do a job than Sean does. Together, they can do the job in 2 hours. How long does it take Tim to do the job alone?

- a. 2 hours
- b. 3 hours
- c. 5 hours
- d. 6 hours
- e. NOTA

27. Solve for all x. $\frac{x^2 + 6x + 5}{x^2 - 1} \geq 0$.

- a. $x \leq -5$
- b. $x \geq 1$
- c. $x \leq -5$ or $x > 1$
- d. $x \leq -5$ or $x \geq 1$
- e. NOTA

28. A recent earthquake measured 9.1 on the Richter scale, while the 1906 San Francisco earthquake measured 8.25. How many times more intense was the recent earthquake? ($I = 10^R \cdot I_0$, where R is the Richter scale measurement.) Round to the nearest tenth.

- a. 0.9
- b. 1.1
- c. 7.1
- d. 15.0
- e. NOTA

29. During the winter, Tom's radiator contains 16 liters of a mix that is 70% antifreeze and 30% water. To prepare for spring, how much must be drained and replaced with pure water for the radiator to contain 16 liters of 55% antifreeze and 45% water? Round answer to the nearest hundredth.

- a. 3.43 liters
- b. 8.00 liters
- c. 5.25 liters
- d. 8.80 liters
- e. NOTA